B.6 EXTENDED/DRY DETENTION BASINS OR UNDERGROUND DETENTION TANKS

DESCRIPTION

Extended/dry detention basins are depressed basins that temporarily store a portion of stormwater runoff following a storm event. Underground detention tanks function similar to detention basins. However, since underground detention tanks are located below ground, the surface above these systems can be utilized for other more useful needs (parking lots, sidewalks, landscaping adjacent to buildings, etc). Water is controlled by means of a hydraulic control structure (orifice and/or weirs) to restrict outlet discharge. The extended/dry detention basins and underground detention tanks normally do not have a permanent water pool between storm events. The objectives of both systems are to remove particulate pollutants and to reduce maximum runoff values associated with development to their pre-development levels. Detention basin facilities may be berm-encased areas or excavated basins. Detention tank facilities may be corrugated metal pipe, concrete pipe, or vaults.

ADVANTAGES

1. Modest removal efficiencies for the larger particulate fraction of pollutants.
2. Removal of sediment and buoyant materials. Nutrients, heavy metals, toxic materials, and oxygen-demanding particles are also removed with sediment substances associated with the particles.
3. Can be designed for combined flood control and stormwater quality control.
4. Requires less capital cost and land area when compared to wet pond BMP.
5. Downstream channel protection when properly designed and maintained.

LIMITATIONS

1. Require sufficient area and hydraulic head to function properly.
2. Generally not effective in removing dissolved and finer particulate size pollutants from stormwater.
3. Some constraints other than the existing topography include, but are not limited to, the location of existing and proposed utilities, depth to bedrock, location and number of existing trees, and wetlands.
4. Extended/dry detention basins have moderate to high maintenance requirements.
5. Sediments can be resuspended if allowed to accumulate over time and escape through the hydraulic control to downstream channels and streams.
6. Some environmental concerns with using extended/dry detention basins, include potential impact on wetlands, wildlife habitat, aquatic biota, and downstream water quality.
7. May create mosquito breeding conditions and other nuisances.

DESIGN CRITERIA

EXTENDED/DRY DETENTION BASINS:

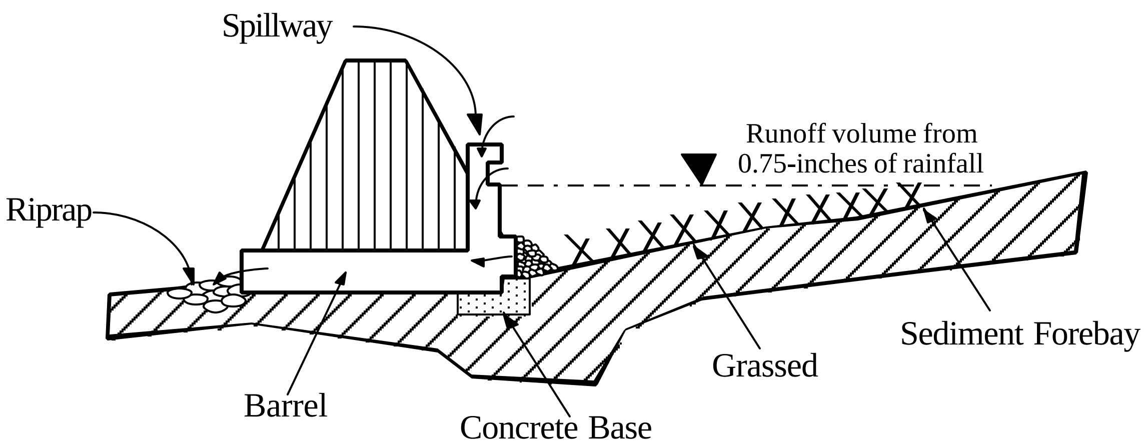

Figure 1. Conceptual elements of typical extended/dry detention structures.

Criteria	***Design Considerations***
Storage volume	Calculate the volume of stormwater to be mitigated by the extended/dry detention basin using the Los Angeles County Department of Public Works *Method for Calculating Standard Urban Stormwater Mitigation Plan (SUSMP) Flow Rates and Volumes Based on 0.75-inches of Rainfall*. Provide a storage volume for 120 percent of the runoff volume generated from 0.75-inches of rainfall above the lowest outlet in the basin. The additional 20 percent of storage volume provides for sediment accumulation and the resultant loss in storage volume.
Emptying time	A 24- to 48-hour emptying time should be used for the runoff volume generated from 0.75-inches of rainfall, with no more than 50 percent of the 0.75-inches of rainfall being released in 12 hours.
Basin geometry	Shape the pond with a gradual expansion from the inlet and a gradual contraction toward the outlet, thereby limiting short circuiting. The basin length to width ratio should be not less than 4.
Two-stage design	A two-stage design with a lower frequency pool that fills often with frequently occurring runoff minimizes standing water and sediment deposition in the remainder of the basin can enhance water quality benefits. The bottom stage should store 10 to 25 percent of the runoff volume generated from 0.75-inches of rainfall.
Low-flow channel	Conveys low base flows from the forebay to the outlet. Erosion protection should be provided for the low-flow channel.

Basin side slopes	Slopes should be stable and gentle enough to limit rill erosion and facilitate maintenance access and needs. Side slopes should be no steeper than 4:1 (H:V), preferably flatter.
Inlet	Dissipate flow energy at basin's inflow point(s) to limit erosion and promote particle sedimentation.
Forebay design	Provide the opportunity for larger particles to settle out in an area that has, as a useful refinement, a solid surface bottom to facilitate mechanical sediment removal. The forebay volume should be 5 to 10 percent of the runoff volume generated from 0.75-inches of rainfall.
Outlet design	Use a water quality outlet that is capable of slowly releasing the runoff volume generated from 0.75-inches of rainfall over a 24- to 48-hour period. A perforated riser can be used in conjunction with orifices and a weir box opening above it to control larger storm outflows. A cutoff collar should be considered for the outlet pipe to control seepage.
Perforation protection	Provide a crushed rock blanket of sufficient size to prevent clogging of the primary water quality outlet while not interfering significantly with its hydraulic capacity.
Dam embankment	The embankment should be designed not to fail during a 100-yr and larger storm. Embankment slopes should be no steeper than 3:1 (H:V), preferably 4:1, and flatter, and planted with turf-forming grasses. Poorly compacted native soils should be excavated and replaced. Embankment soils should be compacted to at least 95 percent of their maximum density. Spillway structures and overflows should be designed in accordance with local drainage criteria.
Vegetation	Bottom vegetation provides erosion control and sediment entrapment. Basin bottom, berms, and side-sloping areas may be planted with native grasses or with irrigated turf, depending on the local setting.
Maintenance access	Access to the forebay and outlet area shall be provided to maintenance vehicles. Maximum grades should be eight percent, and a solid driving surface of gravel, rock, concrete, or gravel-stabilized turf should be provided.

UNDERGROUND DETENTION TANKS:

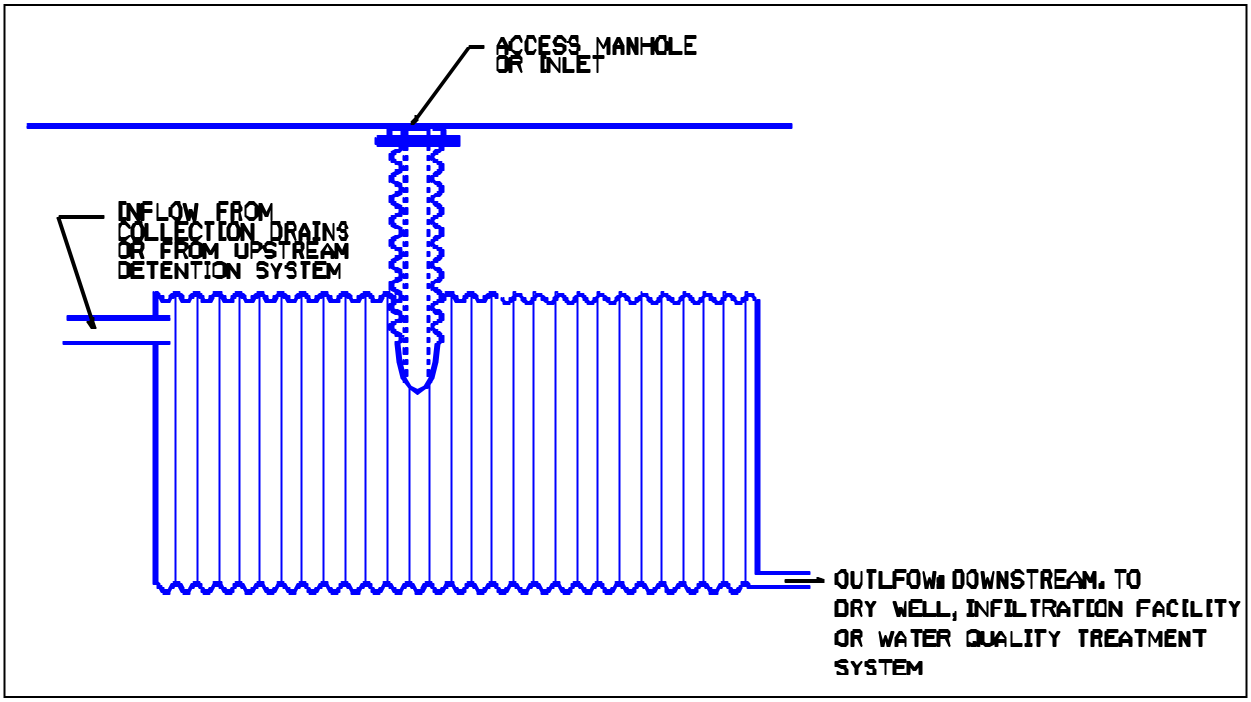

Figure 2. Conceptual elements of typical underground detention structures.

CRITERIA	***DESIGN CONSIDERATIONS***
Storage volume	Calculate the volume of stormwater to be mitigated by the underground detention tank using the Los Angeles County Department of Public Works Method for Calculating Standard Urban Stormwater Mitigation Plan (SUSMP) Flow Rates and Volumes Based on 0. 75-inches of Rainfall Provide a storage volume for 120 percent of the runoff volume generated from 0.75-inches of rainfall above the lowest outlet in the tank. The additional 20 percent of storage volume provides for sediment accumulation and the resultant loss in storage volume.
Emptying time	A 24- to 48-hour emptying time should be used for the runoff volume generated from 0.75-inches of rainfall, with no more than 50 percent of the 0.75-inches of rainfall being released in 12 hours.
Tank geometry	Tank should be constructed to fit within the site layout.
Low-flow outlet	Conveys low base flows from the tank to the outlet.
Outlet design	Use a water quality outlet that is capable of slowly releasing the runoff volume generated from 0.75-inches of rainfall over a 24- to 48-hour period.

Over flow design	Runoff volume generated from a storm greater than a 0.75-inches rainfall event should be diverted via a flow splitter placed at the tank entrance or an overflow weir/orifice system designed in conjunction with the outlet of the tank.
Maintenance access	Access to the tanks shall be provided for maintenance personal.

REFERENCES

1. Camp, Dresser and McKee, Inc., Larry Walker Associates, 1993. *California Best Management Practices - Municipal*, California State Water Resources Council Board, Alameda, CA.

2. GKY and Associates, Inc. June 1996. *Evaluation and Management of Highway Runoff Water Quality*, Publication No. FHWA-PD-96-032. Prepared for: US Department of Transportation, Federal Highway Administration. Washington, DC.

3. K. H. Lichten, June 1997. *Compilation of New Development Stormwater Treatment Controls in the San Francisco Bay Area*, Bay Area Stormwater Management Agencies Association, San Francisco, CA.

4. *Low-Impact Development Design Manual*, November 1997. Department of Environmental Resources, Prince George's County, MD.

5. T. R. Schueler, 1987. *Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs*, Department of Environmental Programs, Metropolitan Washington Council of Governments, Washington, DC.

6. Ventura Countywide Stormwater Quality Management Program, *Draft BMP DD: Extended Dry Detention Basins*, June 1999. Ventura, CA.

7. G. K. Young and F. Graziano, 1989. *Outlet Hydraulics of Extended Detention Facilities*, Northern Virginia Planning District Commission, Annandale, VA.

The following is a list of known locations where an Extended Dry Detention Basin was installed. The design of the installed basin in each location may vary from what is recommended in this SUSMP due to its specific circumstances. Los Angeles County does not endorse nor warranty any design used in the locations herein. Each individual case may require that the design be tailored to perform properly.

Installed Location (City/Address)	Brand/Manufacturer	Owner/Client
I-5/I-605 Intersection	N/A	Caltrans
I-605/SR 91 Intersection	N/A	Caltrans